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Stabilities natural colorant of Sappan wood (*Caesalpinia sappan*. L) for food and beverages in various pH, temperature, and matrices of food

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Abstract : Sappan wood is known as a medicinal component of drugs and beverages that redness color. The aim of this study was evaluated extract of sappan wood (*Caesalpinia sappan*. L) as a natural coloring for foods and beverages, its have a major chemical compound like brazilin as a neoflavonoid and have redness of color. The research was conducted on various of foods and beverages (chips, carbonated drinking, syrup, fruit concentrate, yogurt), various of pH and starch of food (wheat flour, rice flour, breadfruit flour). The results were recommended that extract of sappan wood could use as a natural colorant for foods and beverages with alkali of pH. It could give secondary metabolic compound for food e.g. antimicrobial and antioxidant compound indirectly, it could become as a functional food.
Keywords : sappan wood; brazilin; neoflavonoid; functional food.

1. Introduction

The development of food industries needs innovation on food additives for a better product[1,2]. Whatever, it not enough and no found from a natural product, then we used the synthetic compound. It has the higher intensity of color, efficient for used, and more chief. But the site effect from it was could degenerative and grow cancer cells or the other one as inabilities of our body to eliminate them[1].

Sappan(*Caesalpinia sappan*. L)as known the plant that abundant grown in Indonesia, e.g. West Sumatera, Yogyakarta, North of Sulawesi, Middle of Java and it calls as secang, sappan, sepang or cacang plant. It usually used as medicine for traditional treatment for dengue, and infection of microbial[3]. Typical of soil and difference of climate could influence typical of a metabolic seconder. Sappan wood has a red color of pigment, it name is brazilin. The stability of brazilin has orange and red color on different pH[4]. The applications of sappan wood as a traditional medicine and beverage in water with pH 6-7. It has brazilin as a major metabolic compound of sappan wood which used in traditional water, as known wedangsecang.

Sappan wood has redness color is important to the marketability of food and beverages. Syntheticcoloring agents have commonly been used in the food and beverages industry, but the safety of synthetic coloring agents. However, has been needed. In general, consumer confidence in synthetic food materials has waned. Thus, we need exists for naturally occurring pigments like brazilin from sappan wood. Brazilin as given redness in its solution and it specific from sappan wood.Meanwhile, its compound could give for protection our body from chemical radical in the human body[5].Many researches reported about the secondary metabolic compound in sappan plant, e.g. antioxidant[4,6], antimicrobial[7,8], anticancer[9], anti-inflammation[10]. Antioxidant agent in sappan wood could give the other effect in food and their product like preservatives to chili pasta[11]and meat[12].

This research reported about the effectivity of extract sappan wood as a colorant for food and beverages and study for the stability of it in various pH, a matrix of food and sensory analysis of their product.

2. Methods and Materials

2.1.Materials and Tools

Tools : analytical balance, glassware for chemical analysis, decicator, blender, centrifuge, thermometer, rotary evaporator, water bath.**Chemicals** :sappan wood, methanol 95%(v/v), various of carbohydrate, extract/slurry of fruits, vegetable oils, and aquadest.

2.2 Extraction of sappan wood

Sappan wood was collected from traditional market, minced, extracted by 500 mL ethanol 96%for 3x24 jam in 27-28^{o}C than evaporate the solvent by rotary evaporator at 80^{o}C. Extract dried at room temperature for 3-4 days, in sterile plate. The solid extract of sappan wood was used for the experiment.

a. Test for stabilities extract versus change and various of pH medium
b. Test for stabilities extract in beverages of fruit : orange, lime, milk, sugar solution, yogurt, carbonated water. The observation was done at 12 hours, 24 hours, 36 hours and 48 hours.
c. Interactions the extract with carbohydrate compound

The product for this experiment was chips like snack food and cassava chips and extract of sappan wood for 1 %, 3% and 5% (w/w).

3. Result and Discussion

3.1. Extraction of brazilin and brazilein

Sappan wood has flavonoid compound which classified as neoflavonoid and its name is brazilin (7,11b-dihydrobenz [b] indeno[1,2-d]pyran-3,6a,9,10 (6H)-tetrol). It is the major component isolated from the heartwood of *Caesalpinia sappan*[3,4,6]. The oxidation reacts and light effect changedit to brazilein and itscolor is red.

Figure 1. The exchange color of brazilin become brazilein[6]

In the present study, the effect of temperature on the stability of sappan extract wasanalyzed. It has a redness pigment which stability in high temperature although must boil in hot water. Figure 2 was description stability of color from sappan. Meanwhile, the other compound in natural product usually not stable in high temperature, so we must do with low temperature for keep stabilities of them. Sappan plant (*Caesalpinia sappan L.)*was used for traditional medicine in Indonesia because it has several of compound like flavonoid, alkaloid,and tannin[12].

Figure 2. Stability of sappan wood in high temperature

The active compound from natural product always thermolabile and change to the other compound. The isolation procedure for that compound must be done at low temperature or room temperature (27-28^{o}C) to keep stabilities of them. This research was done by extraction in ethanol 96% (v/v). Temperature could effect to oxidation and reduction to thechemical compound, moreover degradation of that compound to the simple compound[2].The stability of chemical compound in natural product effected by temperature and the method of isolation.

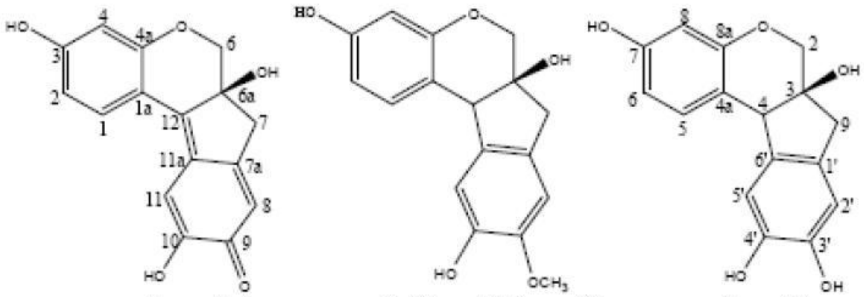
Sappan wood has characteristic sensory like redness color in water, pH 7, no odor and taste, so it could be as a colorant for food without changing the characteristic of them. It was different with rosela flower (*Hibiscus sabdariffa*), which has acid taste in water (Figure 3). The pH of rosela flower was 3-4 and it effected to taste of food. Table 1 identified the characteristic brazilin of sappan wood.

Table 1. Characteristic of brazilin from sappan wood[4]

Chemical and Physical properties	Characteristic of brazilin
Polarity	Polar
Solution	soluble in polar solvents
Melting point	150^{o}C
Optical density	± 122^{o}C
Temperature dissolve	>130^{o}C
Odor	No odor or aromatic odor
pH	4,5 – 5,5
Color	Yellow and redness

Figure 3. The solutions of sappan wood and rosela flower

The brazilin as known chemical compound of sappan wood with redness color. Figure 4 identified the structure of brazilin was 7,11b-dihydrobenz [b] indeno[1,2-d]pyran-3,6a,9,10 (6H)-tetrol) and it could be neoflavonoid compound which has three structures of it[3,5].



brazilein **3-*O*-metil brazilin** **brazilin**

Figure 4.The structure of brazilin[5]

The extract of sappan wood is used as a pH-sensitive acid-base indicator and medicinally useful dye. Phenolic compounds, which are famous for their antioxidant capability through radical scavenging and inhibition of enzymes responsible for radical production, were isolated from *Caesalpinia sappan*. L, such ushomoisoflavonoid and related compounds, protosappanin A, protosapponin B, brazilin and brazilein[4].

3.2. Stability of extract sappan wood in various of food

The red color of sappan wood could be different in various food and beverages. Table 1 was identified the color of its.

Table 1. Identification of sappan wood color in various food and beverages

Sample	pH	Color
Carbonated drink	9	red (+++)
Syrup	7	red (++)
Orange juice	4	yellow(--)
Guava slurry	6-7	yellow redness (+)
Watermelon slurry	7	red (+)
Tomato juice	5	-
Rosella flower	3-4	-
Yogurt	4	-
Sugar solution	7	red (++)
Milk	7	pink (+)

+ : intensities of color, - : no color

3.3. Interaction of extract sappan wood with carbohydrate in food

Figure 5 describe the differently color of sappan wood in various flour as wheat flour, cassava flour, and breadfruit flour. They always used to make chips for snack food. The sappan extract was add in their solution and becomesdifferent color. The wheat flour has redness color, the cassava flour has red color but in breadfruit flour , its became yellowness. All of it have affected by pH of matrices.

Figure 5. The color of sappan wood in wheat flour, cassava flour, and breadfruit flour

Sappan wood could use as colorant for food and beverages while the pH of medium range 7-9 and its color was red. It could use functional of the synthetic a colorant knew Rhodamin B meanwhile it is could be a toxic compound for the human body. Chemical compound for food additive must be safety for our health and it must be good if it could give effect to our body as a functional and medicine like inhibitory effect for activities enzyme e.g. hyaluronidase from radical agent[13].

4. Conclusion

Sappan wood has used as a colorant for food and beverages with high-temperature processing. The efficiency was effect by pH and typical of food matrix especially for carbohydrate compound and composition of food. The red color becomesvisualization while the matrix of food was the base (pH> 7) like carbonated drinking, syrup and cassava chips. For the future, it must be studied for the formulation of food functional added sappan wood.

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